UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/914,456	08/28/2001	Jaydeep Sinha	ADE-066XX	5339

207	7590	03/31/2006	

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EXAMINER
SETH, MANAV

ART UNIT	PAPER NUMBER
2624	

DATE MAILED: 03/31/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	**Applicant(s)**
Office Action Summary	09/914,456	SINHA ET AL.
	Examiner	**Art Unit**	
	Manav Seth	2624	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on _23 January 2006_.

2a) ☐ This action is **FINAL.** 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) _1-30_ is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) _1-30_ is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☐ All b) ☐ Some * c) ☐ None of:

      1. ☐ Certified copies of the priority documents have been received.

      2. ☐ Certified copies of the priority documents have been received in Application No. _____.

      3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.1 14

1.   A request for continued examination under 37 CFR 1.114, including the fee set forth in 37

CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for

continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1 .17(e) has been timely

paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114.

Applicant's submission filed on 23 January 2006 has been entered.

Response to the Amendment

1.   Amendment filed on 23 January 2006 has been entered in full.

2.   Applicant's amendments and arguments to the claims have been fully considered but are

moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

3.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness

rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section
> 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the
> subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary
> skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the
> invention was made.

4.   Claims 1-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Williams et al.,

U.S. Patent No. 6,199,986, further in view of Neal et al., U.S. Patent No. 6,547,395, and further in

view of Evans et al., U.S. Patent No. 5,739,906.

Regarding **claim 1 and 14,** Williams et al. ("Williams") discloses receiving noisy data as a

vector, each element of which corresponds to one sample point (Col. 10, lines 50-60; Col. 19, lines

18-67; Col. 21, lines 13-67, Col. 22, lines 13-67; Col. 10, lines 6-49; Col. 6, lines 20-67); and

calculating coefficients of a polynomial which converts said noisy data vector to a 2D function

continuously representing the artifact in the 2D space (Col. 21, lines 13-67, Col. 22, lines 1-24; Col.

19, lines 32-48). Williams discloses performing noise (aberration) reduction on the noisy data from

an eye but does not teach performing noise reduction on the noisy data from a wafer specimen.

However, Neal et al. ("Neal") teaches general concept of optical metrology in which a

surface to be measured, e.g., lens (eye being a lens), mirror, wafer, metal of plastic film, disk platen,

etc., is used as a reflector for a light beam and this reflected light beam is measured with an optical

sensor that measures the wavefront or phase of the beam (col. 1, lines 35-40). Neal further teaches

the use of **wavefront measuring concept** in which the data is interpreted and analyzed to produce

the surface shape of the specimen such as hard disk platens (col. 1, lines 55-60) and **further**

discloses measuring the whole surface by performing measurements at various positions of

the wafers (col.2, lines 23-32). Neal further teaches that the use of wavefront measurement concept

in the ophthalmic measurement where the reflected light information from the eye retina is

measured through the optical system that measures the wavefront (col. 2, lines 45-50, figure 3 and

4). Examiner in view of Neal asserts that Neal provides the teachings where **wavefront**

measurement is used for analyzing the surface of hard disks platen, wafers and the human eye and

Neal further acknowledges that a shape of the object under measurement can be determined using wavefront measurement interferometers.

Examiner, in order to provide more support for this well-known method as described by Williams and Neal, of using wavefront measurements, cites Evans et al. ("Evans"). **Evans teach noise reduction from noisy data representing an artifact at sample points in two-dimensional space of a wafer specimen (col. 1, lines 50-55). Evans in col. 1, lines 50-55 determines a bow (a noise) on the wafer and separates or reduces its effect from the thickness variation measurement of the wafer.** Evans further discloses the use of a wavefront measurement using interferometers to further determine the wafer thickness measurement (col. 2, lines 10-20) and further calculates Zernike coefficients of a polynomial to represent the bow (noise) in the two-dimensional representation (col. 9, lines 55-67 through col. 10 lines 1-42). Examiner further asserts that once the wavefront of the object surface is obtained by the sensor and converted into electrical signals, it would be obvious for one of ordinary skill in the art at the time of invention was made to use Williams method, a well known method, of reducing noise from noisy data representing an artifact at sample points in two dimensional space of a specimen in view of Neal and Evans, as Williams also admits using wavefront construction in determining the displacement of each spot from its ideal location due to wavefront aberration (noise) (col. 6, lines 20-24) and it being a matter of replacing human eye with a wafer as both objects have surface and wavefront measurement as discussed before is applicable to both objects and thus providing the motivation of using the combined teachings of all three references as all three references belong to the same field of measuring object surface for shape (homogeneity) variations with respect to wavefront measurement. **Also, Neal further discloses "computer hard disk platens are spun at a high revolution rate. This can induce vibrations, modes, and surface shape changes that are only**

present during operation. With an interferometer, these deformations can be measured"
(col. 2, lines 10-5), where vibrations, modes and surface shapes here are noise which are
contributed by the apparatus (such as WAFERCHECK, when used which includes both the
wafer movement and measuring functions) and can be measured using interferometers and
interferometers use wavefront measurements to do so and Neal and Williams provide the
same kind of wavefront measurements using Zernike polynomials.

Williams further discloses discloses the noisy data (aberrations) is obtained using a measuring
apparatus (figure 2; Col. 19, lines 18-31, using the wavefront sensor 10) (Also, see Evans: figure 1,
use of interferometer, **Evans in col. 1, lines 50-55 determines a bow (a noise) on the wafer
which is obtained using a measuring apparatus**) and further discloses wherein said calculating
step includes mathematically multiplying said data vector by a matrix representing a noise
characteristic of said measuring apparatus (Col. 18, lines 59-68; Col. 19, lines 1-68; Col. 20, lines 1-
35; **Col. 21, lines 13-67** (mathematical multiplication of data vector by a matrix representing noise
characteristic of the apparatus where noise characteristic being wave aberration where wave
aberration is defined by basis functions and matrix related to the lenslets of the measuring
apparatus), Col. 22, lines 1-24,)(Also see, Evans: col. 2, lines 8-20; col. 7, lines 45-55, col. 8, lines 60-
63).

Regarding claims 2 and 30, Williams discloses the sample points lack regular geometrically
prescribed locations on specimen (Figure 6).

Regarding claims 3 and 15, Williams discloses a non-rectilinear specimen (Abstract). Also, Neal teaches a non-rectilinear specimen in figure 3 and 4.

Regarding claims 4 and 16, Williams discloses sample points having a sufficiency to represent the spatial frequency of the noise to be reduced (Col. 11, lines 45-67, Col. 12, lines 1-5).

Regarding claims 5 and 17, Williams discloses using Zernike polynomials (Col. 21, lines 66-67, Col. 22, lines 1-24). Also, as discussed in the rejection of claim 1, Evans discloses using Zernike coefficients.

Regarding claims 6 and 18, Williams discloses the calculated coefficients are fewer in number than the number of sample points (Col. 10, lines 27-49).

Regarding claims 7 and 19, Williams (as also discussed in the rejection of claim 1) discloses wherein said calculating step includes mathematically multiplying said data vector by the matrix representing the noise characteristic of said measuring apparatus, and wherein said matrix represents a least squares fit between the data vector and the polynomial (Col. 21, lines 13-67, Col. 22, lines 1-24).

Regarding claims 8 and 20, Williams discloses the matrix is a single value decomposition (Col. 21, lines 13-67, Col. 22, lines 1-24).

Regarding claims 9 and 21, Williams discloses calculating specimen spatial artifacts from said polynomial for one or more points in 2D space (Col. 19, lines 18-67).

Regarding claims 10 and 22, Williams discloses using a computer (Figure 3), but does not appear to specify transmitting coefficients to a remote location prior to the calculation of spatial artifacts from the polynomial. However, it is very well known in the art, that a computer can be connected to other remote computers through a network using LAN or internet and also it is well known that any information in the electronic form can be transferred from one location to another. Therefore, one of ordinary skill in the art keeping this well-known fact in view, will be able to transfer or transmit the electronically stored coefficient to a remote location.

Regarding claims 11 and 23, Williams discloses receiving data representative of artifacts in 2D space of a specimen obtain by a measurement apparatus, each data point associated with a data position (Col. 19, lines 18-67; Col. 21, lines 13-67, Col. 22, lines 13-67; Col. 10, lines 6-49); and calculating a specimen-independent noise compensating matrix as a function of said data position in 2D space of said specimen (Col. 21, lines 13-67, Col. 22, lines 1-24; Col. 19, lines 32-48). All other limitations have been similarly analyzed and rejected as per claim 1.

Regarding claims 12 and 13, the arguments analogous to those presented above for claims 7 and 5 are applicable to claims 12 and 13, respectively.

Regarding claim 24, the arguments analogous to those presented above for claim 7 are applicable to claim 24.

Regarding claim 25, Williams discloses the matrix is of the form of a multiplier of a
Zernike polynomial without decomposition coefficients (Col. 10, lines 6-49).

Regarding claim 26, Williams discloses a computer for calculating coefficients (Col. 16,
lines 5-62).

Regarding claim 27, Williams discloses obtaining a set of noisy data points by a measuring
apparatus (figure 2, Col. 19, lines 18-67; Col. 21, lines 13-67, Col. 22, lines 13-67; Col. 10, lines 6-49);
using a complete set of Zernike polynomials as a shape functional space (Col. 19, lines 17-67);
applying a weighted least squares fit between said noisy data points and a set of data points
calculated from Zernike polynomials; and finding decomposition coefficients (Col. 21, lines 13-67,
Col. 22, lines 1-24). Williams does not disclose determining wafer shape. However, Evans et al.
("Evans") teaches that it is known to obtain data representing a wafer shape and use a complete set
of Zernike polynomials as a shape functional space (Col. 7-10). Also, Neal as discussed in the
rejection of claim 1, discloses the shape construction of the object under measurement (See Neal,
col. 1, lines 60-65). All other supporting arguments can be found in the rejection of claim 1.

Regarding claim 28, Williams discloses decomposition coefficients associated with Zernike
polynomials (Col. 21, lines 13-67, Col. 22, lines 1-24), thereby having a compact data representation.
The arguments analogous to those presented above for claims 27 and 1 are applicable to claim 28.

Regarding claim 29, Williams discloses a set of noisy data points from a scanning pattern that is not necessarily evenly spaced (Col. 9, lines 49-67, Col. 10, lines 1-5).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Manav Seth whose telephone number is (571) 272-7456. The examiner can normally be reached on Monday to Friday from 8:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta, can be reached on (571) 272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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March 24, 2006